

Amendments to the Specification

Please replace the paragraph at page 2, lines 16 through 21 with the following amended paragraph:

Q1 Model accuracy results from using large step changes, ensuring minimal correlation between MV's and minimal feedback correlation, and ensuring that the step test sequence spans the full frequency range from very fast to very slow steps relative to the Time-to-Steady-State (TTSS) of the process. Unwanted feedback correlation ~~result~~ results from the need to make frequent correcting moves in the MV's to counteract the effect of large unmeasured disturbances, and can degrade the accuracy of the model.

Please replace the paragraph at page 3, lines 13 through 23 with the following amended paragraph:

Q2 A significant part of the cost of implementing MPC on major process units, is the cost associated with using highly trained control engineers to supervise the unit while step testing is in progress. The project team often has to supervise the unit on a 24 hours per day, 7 days per week basis to ensure that the step changes do not cause the process unit to exceed safety or operability constraints. Full supervision greatly increases the cost of implementing MPC on large process units with a large MV count, and/or a long time to steady state. The need for an automated algorithm to conduct the step testing of the process unit while ensuring safe operation and keeping all the products within quality specification, while guaranteeing good identification results, has been recognized for a long time and will provide a substantial competitive advantage to ~~it's~~ its inventor.

Please replace the paragraph that bridges from page 5 line 24 to page 6, line 20 with the following amended paragraph:

C3
Superimposing PRBS Signals on top of Controller Outputs: A more sophisticated approach is to use a closed loop control system, e.g., an MPC system like DMC, and superimpose independent PRBS signals on top of every MV. The MPC controller will always respond by ramping out the pulse to return to the previous steady state targets. This modification generates sufficient medium to high frequency information, but it will not excite the low frequency dynamics of the process. In order to generate accurate gain estimates, large step changes in every limiting (or active) dependent variable has to be made, and at least some of these steps have to be maintained for the full TTSS. This improves the low frequency content of the data, but at the expense of a higher level of unwanted MV correlation. This approach has the advantage that it requires little or no supervision once a suitably accurate model has been determined. However, it has the disadvantage that an initial model needs to be available. A further more limiting disadvantage is the fact that all the MV's will move in a highly correlated way. This can cause numerical difficulties for the system identification algorithm, leading to poor model accuracy. Another problem stems from feedback correlation appearing in the MV's due to noise and disturbances in the CV's, which also makes the system identification problem much more difficult. Since the controller responds to maintain the CV at their targets and limits, all the MV's will exhibit correlation. The nearly ideal PRBS signals on each MV will be diluted by the correlation effect resulting from the control action. If the controller is slowly tuned, and large PRBS amplitudes are used, then the PRBS signal can swamp the controller action, in which case the data appears nearly open loop. Ideally, correlation between MV's, and between CV's and MV's must be ~~minimised~~ minimized as far as possible. Specifically, a high degree of feedback correlation due to high frequency noise and unmeasured disturbances is known to cause failure of multivariable model identification algorithms.

Please replace the paragraph at page 8, lines 4 through 14 with the following amended paragraph:

A4
In a preferred embodiment, the present invention method models a process system employing the steps of:

- (a) modeling a subject process system with an initial model;

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Contd.

(b) coupling to the subject process system a multivariable process control system that utilizes said initial model, to control the subject process system;

(c) tuning said multivariable process control system for stable operation of the subject process system; and

(d) using data generated from said ~~multivariable process control~~ subject process system, generating an improved model of the subject process system, said steps of tuning and generating effectively perturbing the subject process system to generate data for model identification of the subject process system.

Please replace the [✓]paragraph at page 13, lines 17 through 24 with the following amended paragraph:

Q5

Ideally, the maximum amplitude step changes need to be made to ~~maximise~~ maximize the signal to noise ratio. The present invention modifies the controller 13 to only follow these step changes in the shadow CV's 25 if none of the original process CV's (stored in 15) will violate their safety and operability limits (i.e. prevent constraint relaxation). This makes it possible to request large step changes in the shadow CV's 25 to maximize the signal to noise ratio, and allowing the MPC controller 13 to determine the largest possible step change amplitudes within the safety and operability constraints of the process unit 11.
